Pantheon Report

Generated at 2018-08-28 17:58:24 (UTC).

Data path: GCE Iowa on `ens4` (*remote*) →GCE London on `ens4` (*local*).

Repeated the test of 4 congestion control schemes twice.

Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

NTP offsets were measured against `time.google.com` and have been applied to correct the timestamps in logs.
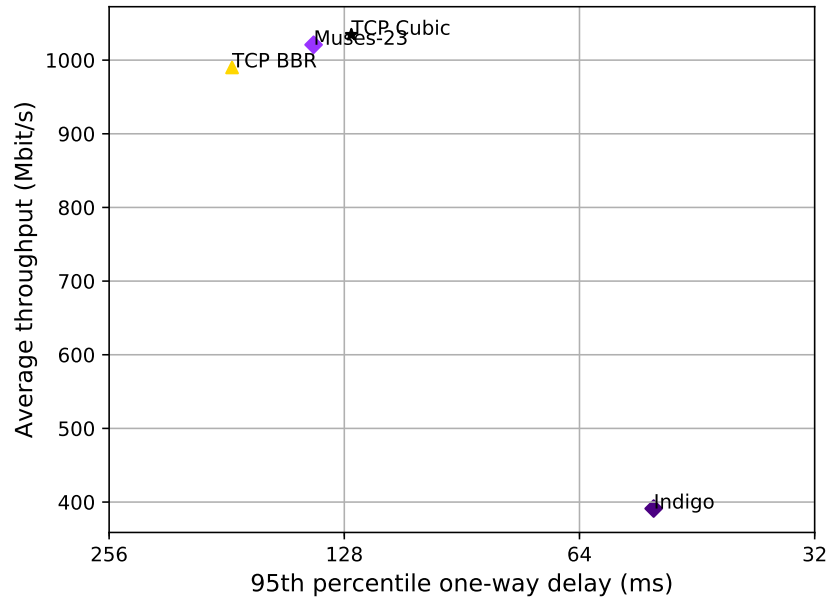
```
System info:
Linux 4.15.0-1017-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912

Git summary:
branch: muses-23 @ 88af05c5b0b7531637ca401951507a2fde628df6
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b261c9e99c63be452bc16f94ce0caa99a4c9d39a
third_party/pantheon-tunnel @ cbfce6db5ff5740dafe1771f813cd646339e1952
third_party/pcc @ 1afc958fa0d66d18b623c091a55fec872b4981e1
 M receiver/src/buffer.h
 M receiver/src/core.cpp
 M sender/src/buffer.h
 M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8acd08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3bdb2
 M src/ScreamClient
 M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f19a26
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```
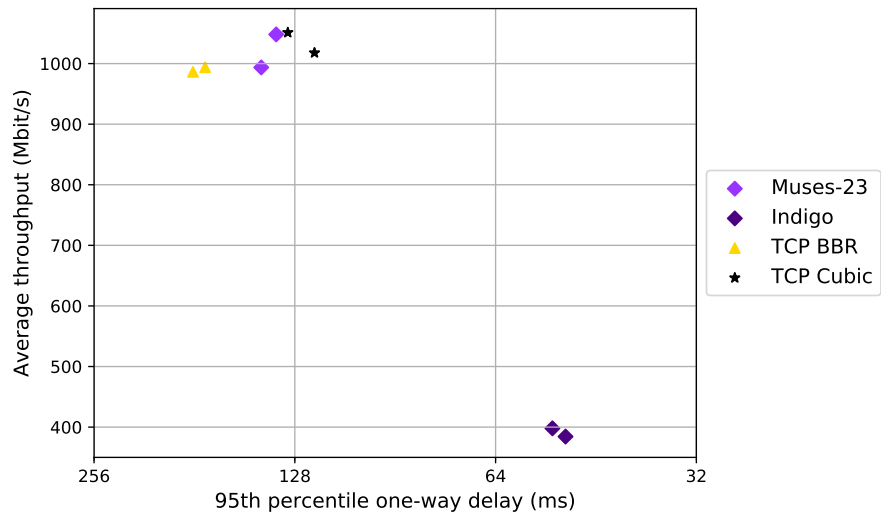
test from GCE Iowa to GCE London, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

test from GCE Iowa to GCE London, 2 runs of 30s each per scheme
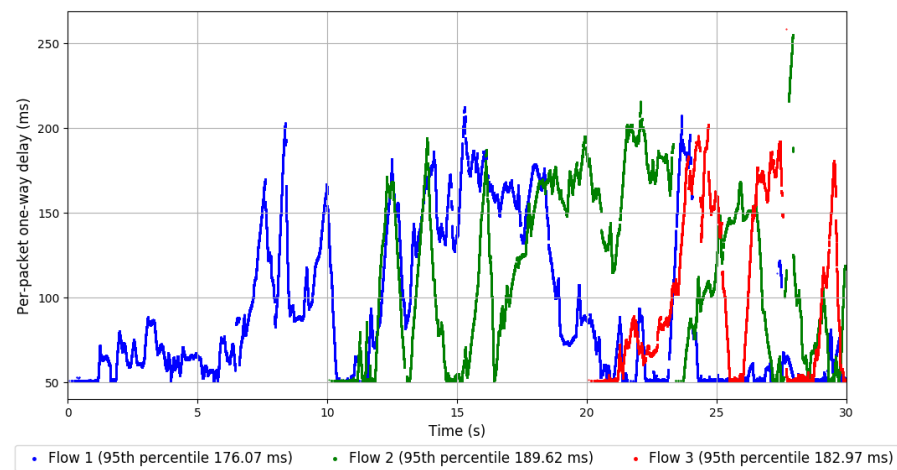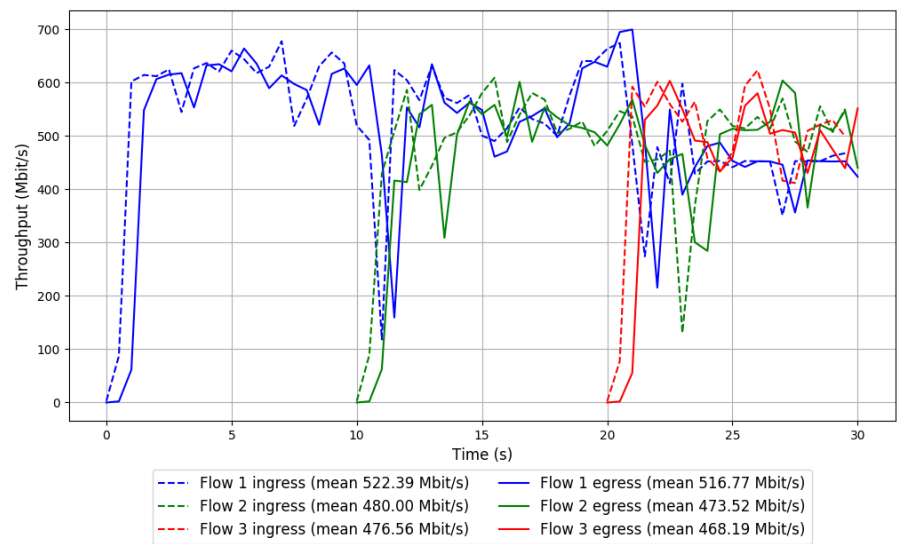3 flows with 10s interval between flows

scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	517.37	475.19	474.31	172.00	194.56	170.89	1.67	1.69	2.55
TCP Cubic	2	553.65	499.78	449.55	129.65	114.10	126.90	0.54	0.57	1.43
Indigo	2	206.07	195.06	172.25	51.50	51.48	50.65	0.35	0.55	1.11
Muses-23	2	523.67	493.65	521.66	140.04	143.98	132.03	2.98	3.69	1.99

```
Run 1: Statistics of TCP BBR

Start at: 2018-08-28 17:28:03
End at: 2018-08-28 17:28:33
Local clock offset: 0.297 ms
Remote clock offset: -0.037 ms


# Below is generated by plot.py at 2018-08-28 17:55:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 986.33 Mbit/s
95th percentile per-packet one-way delay: 181.924 ms
Loss rate: 1.77%
-- Flow 1:
Average throughput: 516.77 Mbit/s
95th percentile per-packet one-way delay: 176.067 ms
Loss rate: 1.41%
-- Flow 2:
Average throughput: 473.52 Mbit/s
95th percentile per-packet one-way delay: 189.622 ms
Loss rate: 1.86%
-- Flow 3:
Average throughput: 468.19 Mbit/s
95th percentile per-packet one-way delay: 182.967 ms
Loss rate: 2.75%
```

Run 1: Report of TCP BBR — Data Link

```
Run 2: Statistics of TCP BBR

Start at: 2018-08-28 17:35:56
End at: 2018-08-28 17:36:26
Local clock offset: 0.224 ms
Remote clock offset: 0.009 ms


# Below is generated by plot.py at 2018-08-28 17:56:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 993.88 Mbit/s
95th percentile per-packet one-way delay: 174.440 ms
Loss rate: 1.87%
-- Flow 1:
Average throughput: 517.96 Mbit/s
95th percentile per-packet one-way delay: 167.929 ms
Loss rate: 1.94%
-- Flow 2:
Average throughput: 476.87 Mbit/s
95th percentile per-packet one-way delay: 199.501 ms
Loss rate: 1.51%
-- Flow 3:
Average throughput: 480.43 Mbit/s
95th percentile per-packet one-way delay: 158.813 ms
Loss rate: 2.35%
```
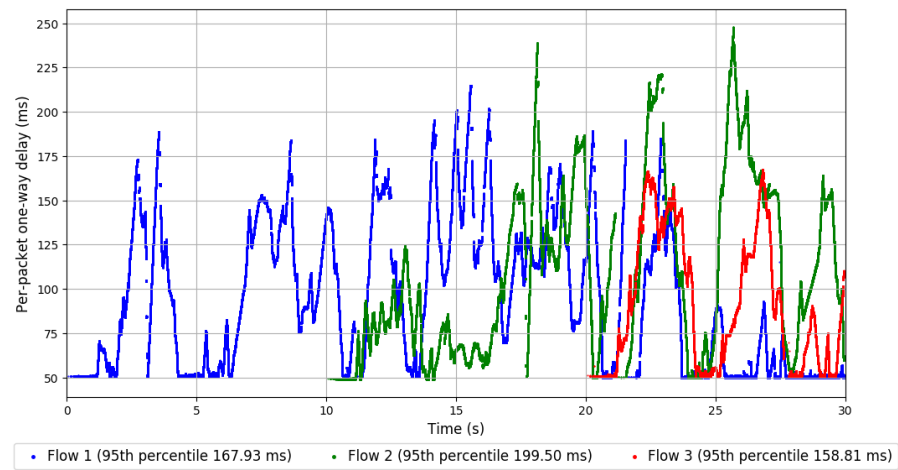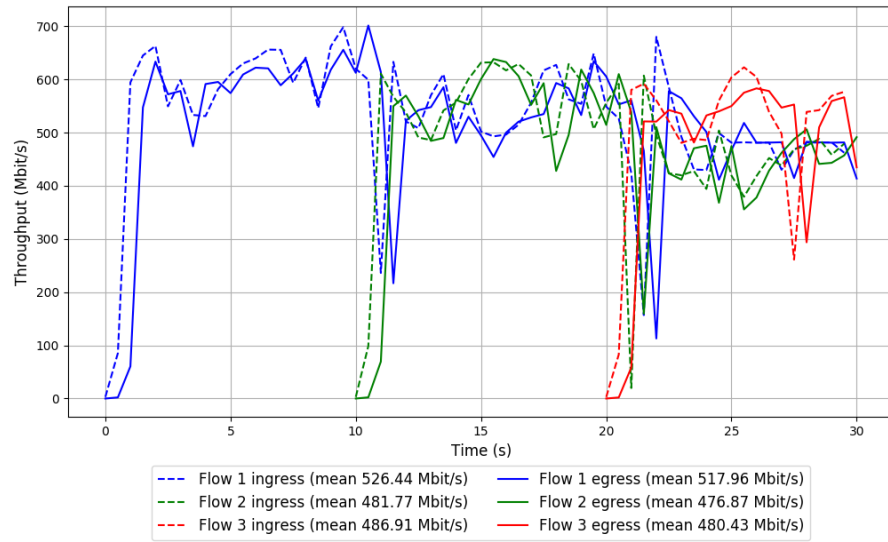
Run 2: Report of TCP BBR — Data Link

Flow 1 ingress (mean 526.44 Mbit/s) — — —   Flow 1 egress (mean 517.96 Mbit/s)
Flow 2 ingress (mean 481.77 Mbit/s) — — —   Flow 2 egress (mean 476.87 Mbit/s)
Flow 3 ingress (mean 486.91 Mbit/s) — — —   Flow 3 egress (mean 480.43 Mbit/s)

Flow 1 (95th percentile 167.93 ms)   Flow 2 (95th percentile 199.50 ms)   Flow 3 (95th percentile 158.81 ms)
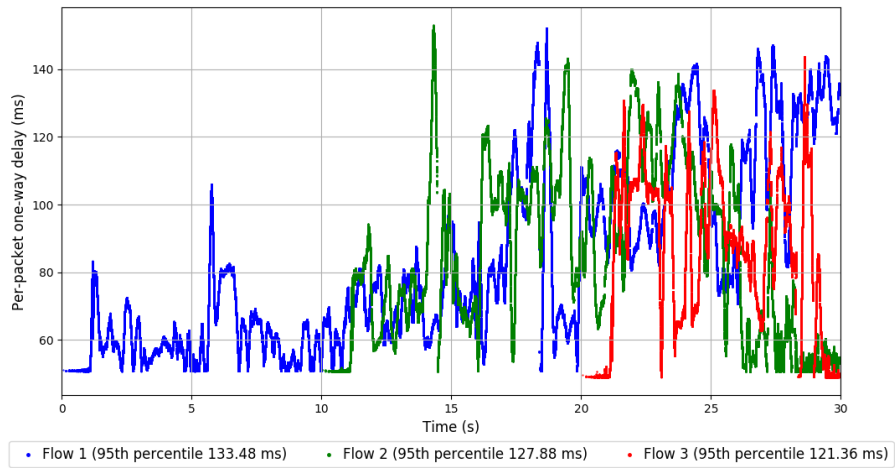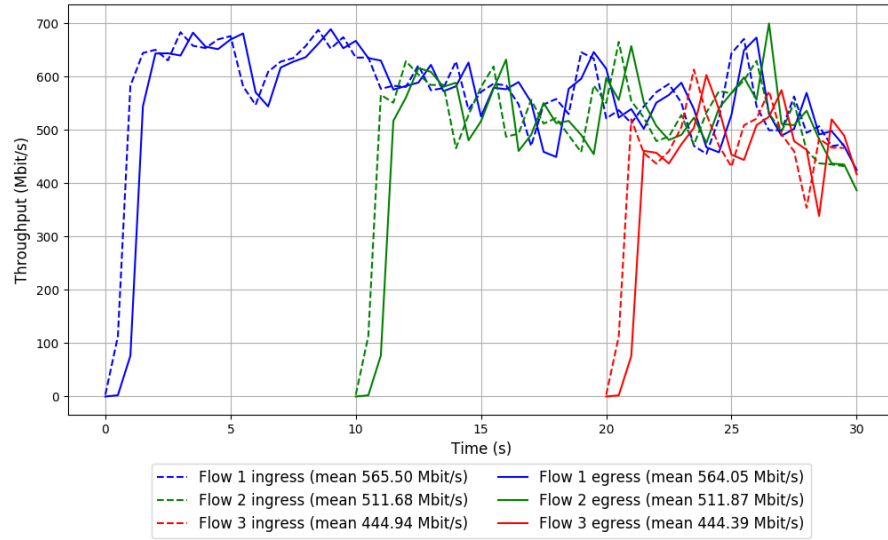
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```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 17:23:57
End at: 2018-08-28 17:24:27
Local clock offset: 0.177 ms
Remote clock offset: -0.078 ms


# Below is generated by plot.py at 2018-08-28 17:56:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1051.18 Mbit/s
95th percentile per-packet one-way delay: 131.144 ms
Loss rate: 0.63%
-- Flow 1:
Average throughput: 564.05 Mbit/s
95th percentile per-packet one-way delay: 133.476 ms
Loss rate: 0.59%
-- Flow 2:
Average throughput: 511.87 Mbit/s
95th percentile per-packet one-way delay: 127.881 ms
Loss rate: 0.46%
-- Flow 3:
Average throughput: 444.39 Mbit/s
95th percentile per-packet one-way delay: 121.364 ms
Loss rate: 1.13%
```

Run 1: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 565.50 Mbit/s) —— Flow 1 egress (mean 564.05 Mbit/s)
Flow 2 ingress (mean 511.68 Mbit/s) —— Flow 2 egress (mean 511.87 Mbit/s)
Flow 3 ingress (mean 444.94 Mbit/s) —— Flow 3 egress (mean 444.39 Mbit/s)

Flow 1 (95th percentile 133.48 ms)   Flow 2 (95th percentile 127.88 ms)   Flow 3 (95th percentile 121.36 ms)

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```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-28 17:31:50
End at: 2018-08-28 17:32:20
Local clock offset: 0.545 ms
Remote clock offset: 0.021 ms


# Below is generated by plot.py at 2018-08-28 17:56:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1017.75 Mbit/s
95th percentile per-packet one-way delay: 119.593 ms
Loss rate: 0.74%
-- Flow 1:
Average throughput: 543.26 Mbit/s
95th percentile per-packet one-way delay: 125.832 ms
Loss rate: 0.50%
-- Flow 2:
Average throughput: 487.69 Mbit/s
95th percentile per-packet one-way delay: 100.329 ms
Loss rate: 0.69%
-- Flow 3:
Average throughput: 454.71 Mbit/s
95th percentile per-packet one-way delay: 132.439 ms
Loss rate: 1.73%
```
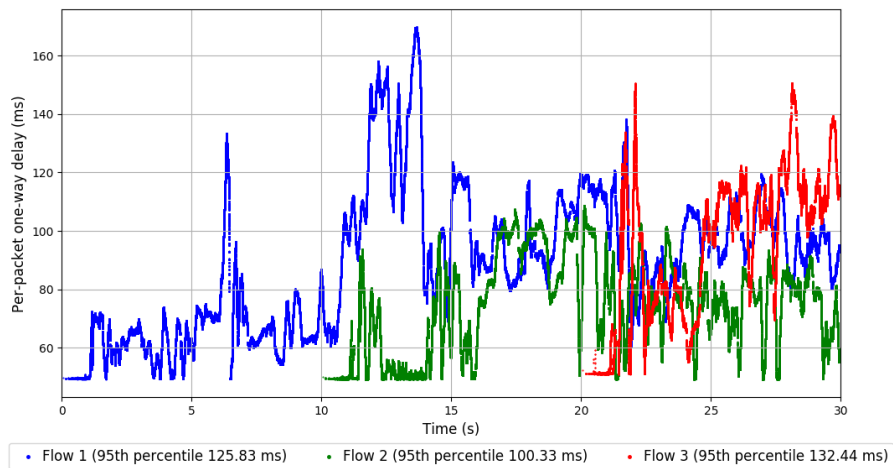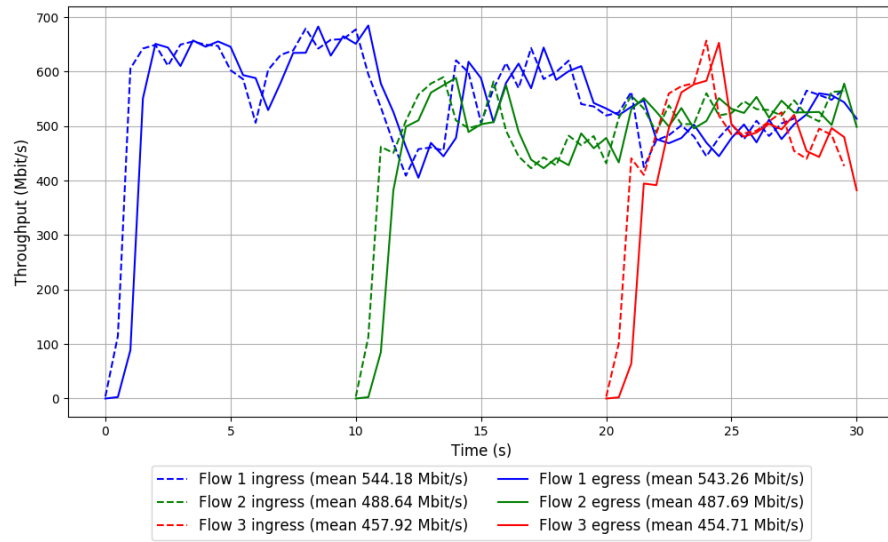
Run 2: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 544.18 Mbit/s) --- Flow 1 egress (mean 543.26 Mbit/s)
Flow 2 ingress (mean 488.64 Mbit/s) --- Flow 2 egress (mean 487.69 Mbit/s)
Flow 3 ingress (mean 457.92 Mbit/s) --- Flow 3 egress (mean 454.71 Mbit/s)

Flow 1 (95th percentile 125.83 ms)   Flow 2 (95th percentile 100.33 ms)   Flow 3 (95th percentile 132.44 ms)
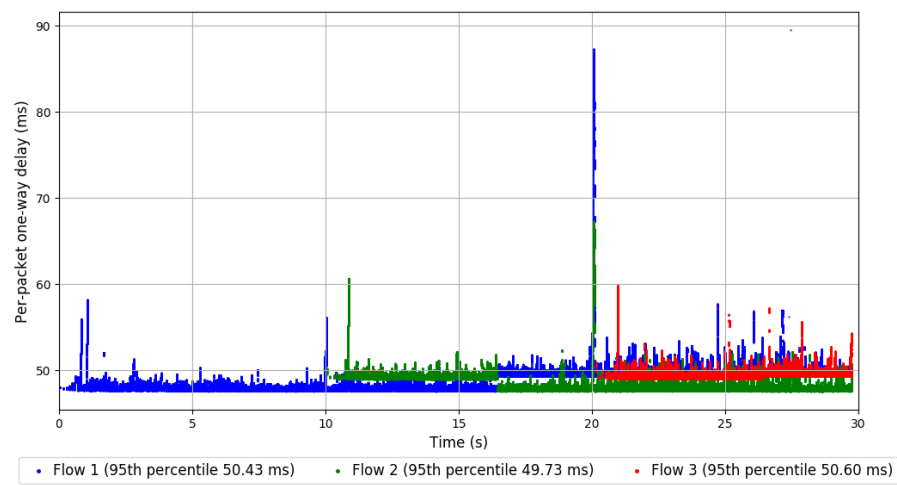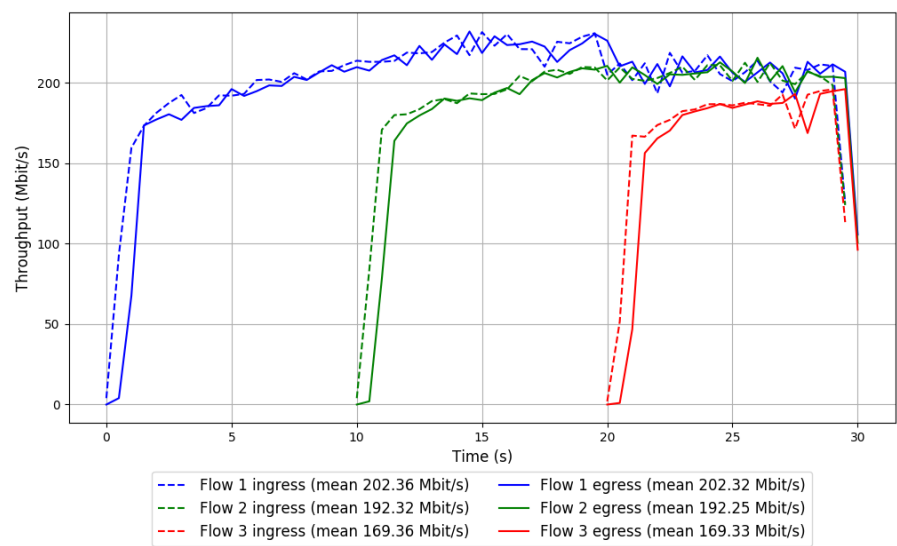
```
Run 1: Statistics of Indigo

Start at: 2018-08-28 17:30:05
End at: 2018-08-28 17:30:35
Local clock offset: -1.158 ms
Remote clock offset: -0.001 ms


# Below is generated by plot.py at 2018-08-28 17:56:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 384.40 Mbit/s
95th percentile per-packet one-way delay: 50.271 ms
Loss rate: 0.52%
-- Flow 1:
Average throughput: 202.32 Mbit/s
95th percentile per-packet one-way delay: 50.433 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 192.25 Mbit/s
95th percentile per-packet one-way delay: 49.728 ms
Loss rate: 0.55%
-- Flow 3:
Average throughput: 169.33 Mbit/s
95th percentile per-packet one-way delay: 50.604 ms
Loss rate: 1.08%
```

Run 1: Report of Indigo — Data Link

Flow 1 ingress (mean 202.36 Mbit/s) --- Flow 1 egress (mean 202.32 Mbit/s)
Flow 2 ingress (mean 192.32 Mbit/s) --- Flow 2 egress (mean 192.25 Mbit/s)
Flow 3 ingress (mean 169.36 Mbit/s) --- Flow 3 egress (mean 169.33 Mbit/s)

Flow 1 (95th percentile 50.43 ms)   •   Flow 2 (95th percentile 49.73 ms)   •   Flow 3 (95th percentile 50.60 ms)
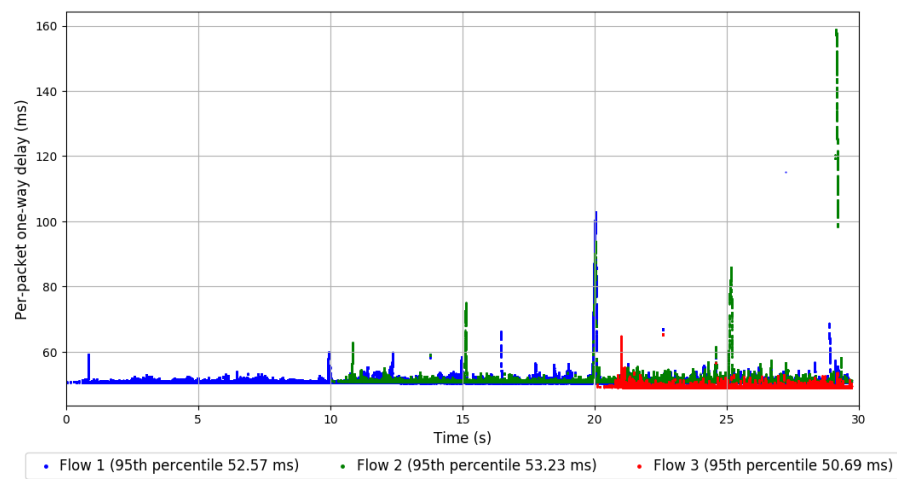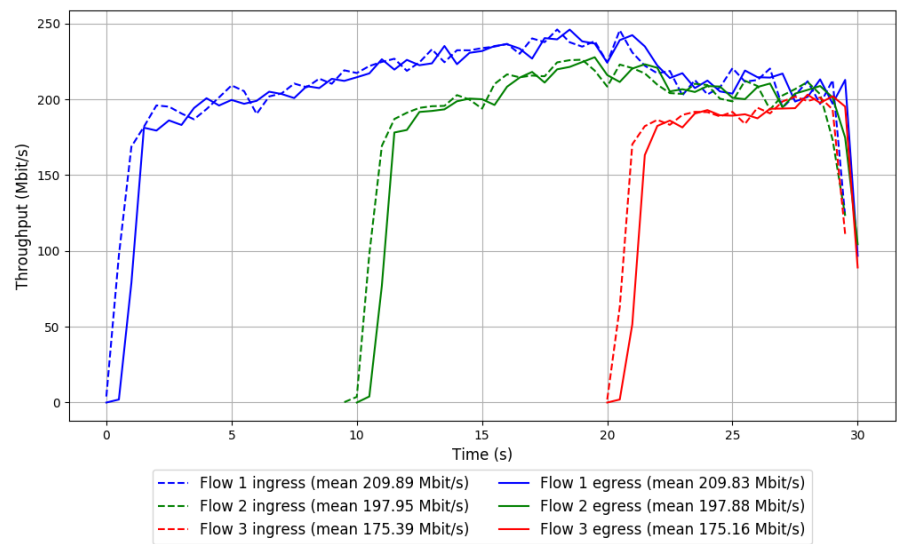
```
Run 2: Statistics of Indigo

Start at: 2018-08-28 17:37:59
End at: 2018-08-28 17:38:29
Local clock offset: 0.203 ms
Remote clock offset: -0.034 ms


# Below is generated by plot.py at 2018-08-28 17:56:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 397.97 Mbit/s
95th percentile per-packet one-way delay: 52.598 ms
Loss rate: 0.53%
-- Flow 1:
Average throughput: 209.83 Mbit/s
95th percentile per-packet one-way delay: 52.571 ms
Loss rate: 0.36%
-- Flow 2:
Average throughput: 197.88 Mbit/s
95th percentile per-packet one-way delay: 53.227 ms
Loss rate: 0.54%
-- Flow 3:
Average throughput: 175.16 Mbit/s
95th percentile per-packet one-way delay: 50.694 ms
Loss rate: 1.15%
```
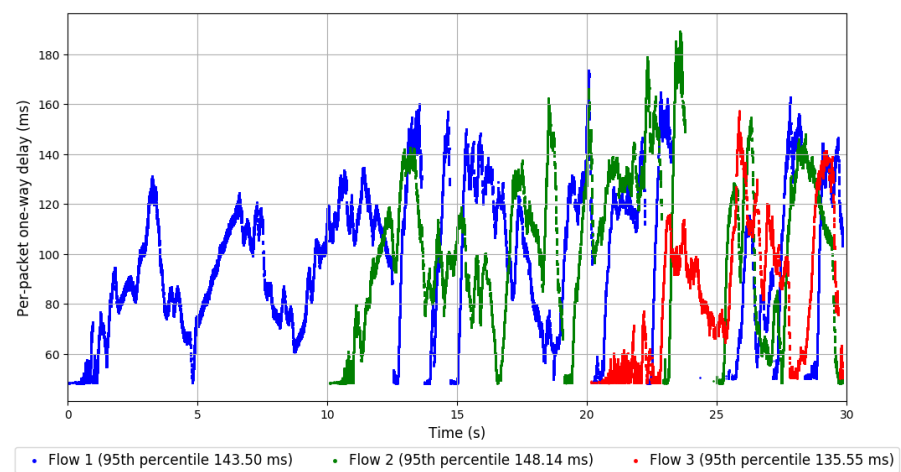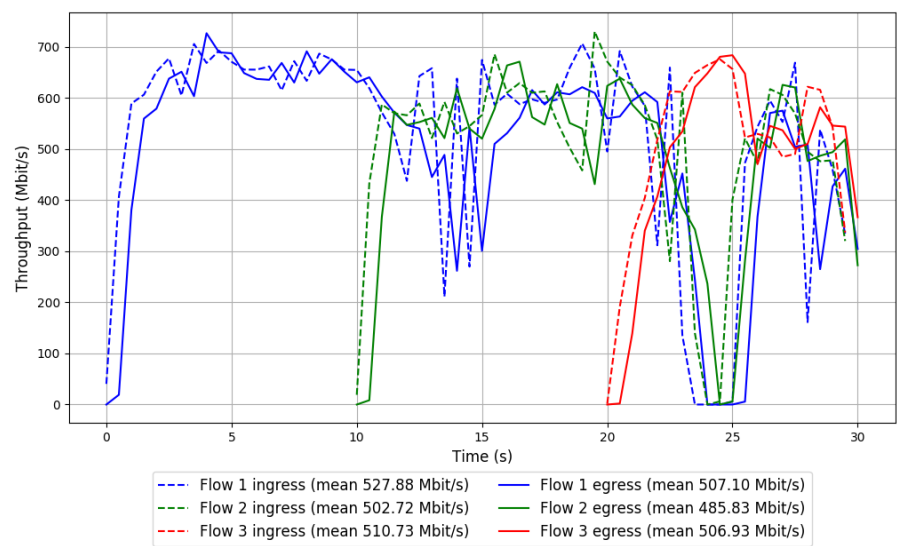
Run 2: Report of Indigo — Data Link

```
Run 1: Statistics of Muses-23

Start at: 2018-08-28 17:25:59
End at: 2018-08-28 17:26:29
Local clock offset: -0.467 ms
Remote clock offset: -0.013 ms

# Below is generated by plot.py at 2018-08-28 17:58:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 993.63 Mbit/s
95th percentile per-packet one-way delay: 143.740 ms
Loss rate: 3.72%
-- Flow 1:
Average throughput: 507.10 Mbit/s
95th percentile per-packet one-way delay: 143.505 ms
Loss rate: 4.26%
-- Flow 2:
Average throughput: 485.83 Mbit/s
95th percentile per-packet one-way delay: 148.140 ms
Loss rate: 3.85%
-- Flow 3:
Average throughput: 506.93 Mbit/s
95th percentile per-packet one-way delay: 135.551 ms
Loss rate: 1.75%
```

Run 1: Report of Muses-23 — Data Link

Flow 1 ingress (mean 527.88 Mbit/s)
Flow 1 egress (mean 507.10 Mbit/s)
Flow 2 ingress (mean 502.72 Mbit/s)
Flow 2 egress (mean 485.83 Mbit/s)
Flow 3 ingress (mean 510.73 Mbit/s)
Flow 3 egress (mean 506.93 Mbit/s)

Flow 1 (95th percentile 143.50 ms)   Flow 2 (95th percentile 148.14 ms)   Flow 3 (95th percentile 135.55 ms)

```
Run 2: Statistics of Muses-23

Start at: 2018-08-28 17:33:49
End at: 2018-08-28 17:34:19
Local clock offset: -0.117 ms
Remote clock offset: -0.035 ms


# Below is generated by plot.py at 2018-08-28 17:58:22
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1048.10 Mbit/s
95th percentile per-packet one-way delay: 136.504 ms
Loss rate: 2.37%
-- Flow 1:
Average throughput: 540.25 Mbit/s
95th percentile per-packet one-way delay: 136.568 ms
Loss rate: 1.70%
-- Flow 2:
Average throughput: 501.48 Mbit/s
95th percentile per-packet one-way delay: 139.829 ms
Loss rate: 3.52%
-- Flow 3:
Average throughput: 536.39 Mbit/s
95th percentile per-packet one-way delay: 128.515 ms
Loss rate: 2.23%
```

Run 2: Report of Muses-23 — Data Link